

Supplement to the Shoreline Analysis and Characterization

This document is a supplement to the *Shoreline Analysis and Characterization* report that was prepared by Grette Associates LLC in 2008 as an element of the City of Burien Shoreline Master Program Update (SMP). This supplement provides

- a refinement to the initial characterization to reflect the diversity along the Puget Sound
- application of DOE's guidance on indicators of No Net Loss (NNL) to Burien's shoreline
- the development of a quantitative metric based on NNL to guide local planning

1) Executive Summary

This supplement groups the nineteen Shoreline Inventory Segments that were identified in the *Supplement to the Shoreline Inventory* in to four Inventory Planning Areas based on environment and existing development conditions.

UC-NA The relatively natural conditions found in the Urban Conservancy designation

SR-AL Altered portions of the Marine that generally include meaningful native vegetation

SR-HA Highly altered portions of the Marine with relatively little ecological function

SR-LB Development around Lake Burien

The development of this analysis included a review of Chapter 4 from DOE's SMP Handbook; *No Net Loss of Shoreline Ecological Functions*. That chapter includes a section on potential no net loss indicators that were developed by DOE staff and advisors to help during the development of SMP updates. Five indicators were selected as particularly relevant for management in Burien's urban shoreline.

A planning metric has been developed, informed by the primary No Net Loss indicators, that summarizes the relative levels of ecological function along the varied shoreline. This metric varies between 0 and 10 where higher values imply more ecological function. The metric has three components that are added together; an indicator of bulkhead intensity that ranges from 0 to 1, an indicator of the level of vegetative function in the first 100' from OHWM that ranges from 0 to 6, and finally an indicator of vegetative function in the second 100' that ranges from 0 to 3. Table 1 provides a preview of this metric for the four planning areas; this table may reflect the effect of rounding. This table includes the typical values, the 50% of values between the 25th percentile and the 75th percentile, for several dimensional indicators using data that was collected for the Supplement to the Shoreline Inventory. The depth and area columns are typical values for properties.

	Length		Setback	Depth (ft)	Area (sq ft) (000's)	Metric			
	ft	%	ft			B	1st 100'	2nd 100'	Total
SR-LB	5,374	100.0	80 - 125	185 - 300	15 - 26	0.3	1.8	0.4	2.6
UC-NA	5,811	22.5	> 200	610 - 740	46 - 70	0.7	4.9	3.0	8.6
SR-AL	13,562	52.5	30 - 95	135 - 250	8 - 18	0.1	2.9	1.5	4.6
SR-HA	6,454	25.0	25 - 75	95 - 200	5 - 9	0.3	0.4	2.2	2.8
Marine	25,827	100.0	30 - 90	125 - 235	7 - 16	0.3	2.7	2.0	5.0

Table 1: Preview of planning areas and the planning metric

2) Characterization

The Grette/Reid evaluation assigned Environmental Designations to each Shoreline Inventory Reach based on the guidelines included in WAC 173-26-211. It was determined that M2 should be designated as Urban Conservancy and the remaining reaches should be designated as Shoreline Residential.

The earlier analysis observed that the Lake Burien reach is a freshwater shoreline and that the remaining reaches are along a marine shoreline but other than this there was little attention to the diversity of conditions that exist across the Shoreline Residential reaches.

The *Supplement to the Shoreline Inventory* demonstrated that existing development conditions along the Marine vary to a significant degree. That work refined the four Marine Shoreline Inventory Reaches into a set of 18 Shoreline Inventory Segments based on patterns of development and well defined geographical identifiers.

This report defines four *Shoreline Planning* areas:

SR-LB: This planning area consists of inventory reach LB. This area is designated as Shoreline Residential along a freshwater shoreline. This reach is zoned as RS-7200 but the current development is consistent with RS-12000 for area, building coverage, and total impervious surface. This area is extensively landscaped. Approximately 2/3 of the length of the shoreline includes bulkheads or retaining walls.

UC-NA: This planning area consists of inventory reach M2. This area is designated as Urban Conservancy environmental designation and is in a substantially natural condition.

SR-AL: This area consists of inventory segments M1-A, M1-C, M1-E, M4-D, M4-E and all of inventory reach M3. This area is zoned as RS-12000 and current development is consistent with this. Many of the properties in this area are impacted by steep slopes that are heavily vegetated. The remainder of the area is generally impervious surface and partially functioning areas. The majority of this area is armored, often with significant structures of over 6' in height.

SR-HA: This area consists of inventory segments M1-B, M1-D, M1-F, M4-A, M4-B, and M4-C. This area is zoned as RS-12000 but current development is closer to the lot-size for RS-7200 with building coverage and total impervious surface that is often denser than even RS-7200 allows. Most of the properties include bulkheads but they tend to be less substantial than those that are common in SR-AL. Segment M4-B, the initial north-west portion of SW 172nd St, presents special development constraints.

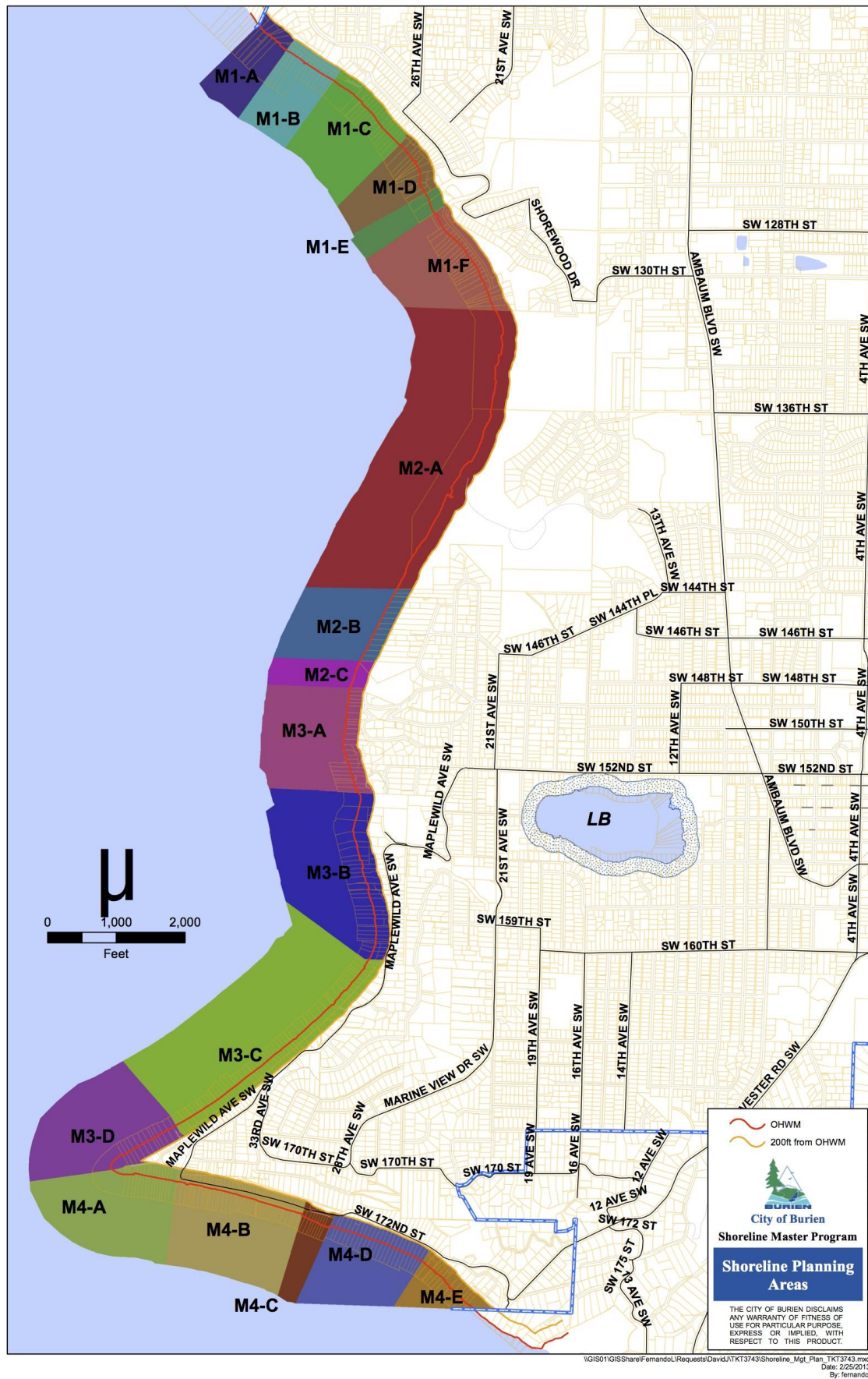


Figure 1: The 5 Inventory Reaches and 19 Inventory Segments



3) No Net Loss Indicators

Under Washington State Shoreline Management Act Guidelines [WAC 173-26-186(8) & 201(2)(c)] all new development, activities and uses must meet the standard of no net loss of ecological functions and shoreline processes, and to meet no net loss, mitigate any adverse impacts of new development.

Chapter 4 of the Department of Ecology's (DOE) Shoreline Master Program Handbook, *No Net Loss of Shoreline Ecological Functions*, suggests that jurisdictions develop quantifiable indicators of Ecological Function and processes. That document provides a table of 15 potential indicators, *Table 4-1 of the handbook*, that might be relevant based on the jurisdiction.

Ten of these indicators were selected as being particularly relevant to Burien's urban shoreline and these were then partitioned these in to two sets as shown in Table 2. The indicators in the first set are relatively easy to measure and, more importantly, are subject to direct control by common city planning techniques. The second set of indicators include those that are either unlikely to change in a 25 year planning horizon or are indirectly impacted by local planning solutions. This partitioning does not imply any judgment regarding the relative importance of these indicators.

Indicator	Functions Affected
Impervious surface area (acres or percentage)	Water quality and habitat
Vegetation coverage; acres/percent by class	Water quality and habitat
Shoreline stabilization; Linear feet of bulkheads, retaining walls, etc.	Sediment supply
Piers/docks/floats, overwater structures; number or sq. ft.	Water quality and habitat
Wetlands acreage	Water quality
Water quality; DOE 303 (d) list	Water quality
Bald eagle & osprey nests and roosts & great blue heron rookeries	Habitat
Area of sea grasses, kelp, and emergent aquatic vegetation	Habitat
Road lengths (ft) within 200' of water body	Water quality
Acres of permanently protected areas	Water quality and habitat

Table 2: Applicable No Net Loss indicators from SMP Handbook

Over time it is appropriate that the City of Burien consider trends in all of these indicators in a shoreline context. Improvements in **all** indicators would suggest that restoration of ecological function has been accomplished while declines in **all** indicators would suggest that net loss has occurred. The concept of **net** loss and mitigation suggests that it is possible to trade-off a decline in one indicator with an improvement in another but there does not appear to be any science or policy guidance to provide an objective model for quantifying this concept.

4) A Metric to Approximate Ecological Function for Shoreline Evaluation

For the purposes of this report, we convert the guidance on *potential Indicators of No Net Loss* into a simple metric that can be used as a supplement to the other descriptive material that is provided. This metric was developed to facilitate a quantifiable evaluation of the varied conditions along Burien's complex shoreline. It is not intended that this metric be used during the permitting process for a proposed development.

This evaluation metric varies between 0 and 10 where 0 represents little or no ecological function and 10 represents broadly natural or unaltered conditions. The metric encompasses shoreline stabilization and the environmental function of the land within shoreline jurisdiction.

It is easiest to think of evaluating this metric for a strip of land 1' wide and 200' deep oriented in a direction that is perpendicular to the line of OHWM. The value for this 1' wide strip can be averaged along any portion of the shoreline in the obvious way.

The metric assigns up to 1 point based on the presence of shoreline stabilization, up to 6 points for conditions in the first 100' from OHWM, and up to 3 points for the next 100'.

Points are assigned to the shoreline stabilization structure if present

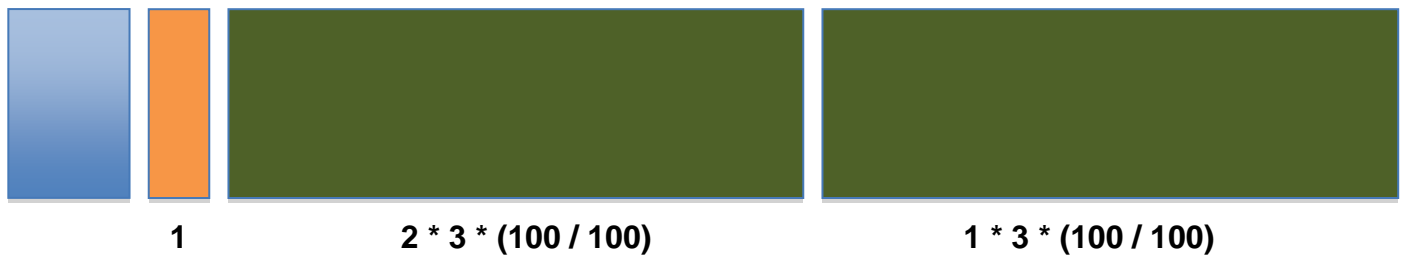
Shoreline Stabilization	Points
Little or no shoreline stabilization.	1.0
A modest wall that is primarily for the highest tides and storm surge	0.5
A significant structure that deflects wave energy on a daily basis	0.0

Points are assigned to each square foot of land

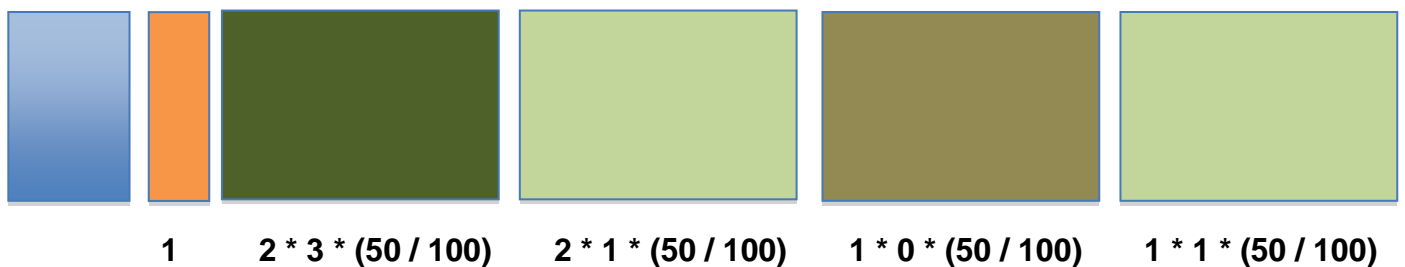
Quality of each Square Foot of Land	Points
Mature native vegetation	3
Partially functioning areas e.g. lawn, landscaping, slat decks [BMC 20.40.101]	1
Impervious surface	0

The points for each sq. ft. are averaged over the first 100' and separately over the second 100'. The final metric is the sum of these three components.

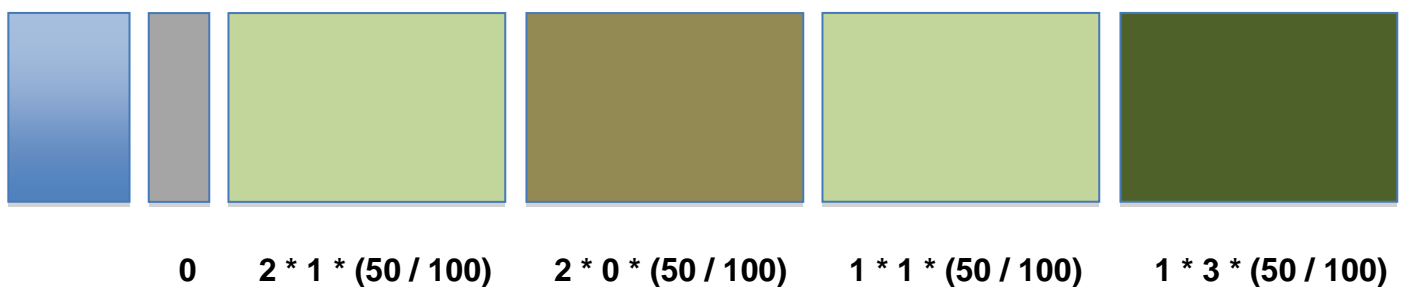
metric = stabilization + 2 * average land value of first 100' + average value for second 200'



A 1' wide strip of property with no bulkhead, 100' of natural conditions, and a second 100' of natural conditions is assigned 10 points: 1 point for the lack of a bulkhead, 6 points for the natural conditions in the first 100' and 3 points for the natural conditions in the second 100'.



A 1' wide strip of property with no bulkhead, 50' of natural conditions, 50' of landscaping, 50' of single family residence, and 50' of landscaping is assigned 5.5 points; 1 point for the lack of a bulkhead, 3 points for 50' of natural conditions in the first 100' from OHWM, 1 point for 50' of landscaping in the first 100' from OHWM, 0 points for impervious surface, and 0.5 points for 50' of landscaping in the second 100' from OHWM.



A 1' wide strip of property with a substantial bulkhead, 50' of landscaping, 50' of SFR, another 50' of landscaping, and a final 50' of natural conditions is assigned 3 points; 0 points for the bulkhead 1 point for 50' of landscaping in the first 100' from OHWM, 0 points for the impervious surface, 0.5 points for 50' of landscaping in the second 100' from OHWM, and 1.5 points for 50' of natural conditions in the second 100' from OHWM.

5) Analysis

In this section the planning areas are analyzed in the context of the indicators of No Net Loss and the proposed planning metric.

5.1) SR-LB

This planning area is the Shoreline Inventory Reach for Lake Burien. The supplement to the Inventory provides a clear overview of primary dimensional indicators for this area.

Indicator	Estimate
Impervious surface area (%)	25% - 45%
Vegetation coverage; percent by class	Primarily landscaped
Shoreline stabilization; Linear feet of bulkheads, retaining walls, etc.	Approx 3600 ft.
Piers/docks/floats, overwater structures; number or sq. ft.	Approx 3/4 of homes
Wetlands area	Approx 30,000 sq. ft.
Water quality; DOE 303 (d) list	Unlisted
Bald eagle & osprey nests and roosts & great blue heron rookeries	A few roosts present
Area of sea grasses, kelp, and emergent aquatic vegetation	None
Road lengths (ft) within 200' of water body	Less than 500'
Acres of permanently protected areas	None

Table 3: Overview of NNL indicators for Lake Burien

It has been noted that Lake Burien is zoned as RS-7200 while existing conditions are typically consistent with RS-12000. This implies that there is some potential for sub-division to occur over the long term although it is difficult to determine how common this is likely to be. While the risk is hotly debated, it appears fair to suggest that significant levels of sub-division and new development would have an adverse impact on several of these indicators.

Approximately 67% of the perimeter includes bulkheads or retaining walls.

Land within the first 100' of OHWM is primarily partially functioning area. Impervious surface accounts for perhaps 10% of the area, on average, and then primarily towards the rear of this region. There are limited levels of native vegetation. There is clear evidence of wetlands at multiple sites; a professional survey would be required to provide an accurate measure of the full extent of the existing wetlands.

Land within the second 100' from OHWM includes substantially higher levels of impervious surface and could account for as much as 50% of the area. The remaining area is primarily partially functioning area.

These observations suggest the following initial estimate for the NNL planning metric

$$\begin{aligned}\text{metric} &\sim 0.33 + 2 * (0 * 3 + 90 * 1 + 10 * 0) / 100 + 1 * (0 * 3 + 50 * 1 + 50 * 0) / 100 \\ &\sim 0.33 + 1.81 + 0.41 \\ &\sim 2.6\end{aligned}$$

5.2) UC-NA

This planning area is the Shoreline Inventory Reach M2.

Indicator	Estimate
Impervious surface area (%)	Relatively little
Vegetation coverage; percent by class	Primarily native
Shoreline stabilization; Linear feet of bulkheads, retaining walls, etc.	Approx 30%
Piers/docks/floats, overwater structures; number or sq. ft.	None
Wetlands acreage	None or Low
Water quality; DOE 303 (d) list	Unlisted
Bald eagle & osprey nests and roosts & great blue heron rookeries	Multiple nest and roosts
Area of seagrasses, kelp, and emergent aquatic vegetation	Present
Road lengths (ft) within 200' of water body	Road and parking lots
Acres of permanently protected areas	80%

Table 4: Overview of NNL indicators for M2

Seahurst Park is just under 75% of the reach. This park provides the primary opportunity for recreation and public access in Burien's shoreline. Conditions are somewhat altered with parking lots, paved walking trails, a small number of structures, and significant levels of armoring. This park has been a focus of restoration efforts for many years and there is ongoing work to reduce the impact due to armoring.

Approximately 40% of Seahurst Park is armored

Within the first 100' Seahurst Park is ~10% impervious surface and 10% partially functioning. The remainder of the land is mature, dense, native vegetation.

Land within the second 100' from OHWM is primarily dense mature native vegetation

The remainder of the reach is almost completely natural for the first 200' from OHWM.

The thirteen private properties account for just under 20% of this reach by length and all but one of the homes sit at the top of an extremely steep slope and over 600' from OHWM.

The remaining 5% of this planning area is Eagle Landing Park which is in a highly natural condition in shoreline jurisdiction.

These observations suggest the following estimate for the NNL planning metric

$$\begin{aligned}
 \text{metric} &\sim 0.7 * 1 + 2 * (80 * 3 + 10 * 1 + 10 * 0) / 100 + 1 * (100 * 3 + 0 * 1 + 0 * 0) / 100 \\
 &\sim 0.7 + 4.9 + 3.0 \\
 &\sim 8.6
 \end{aligned}$$

5.3) SR-AL

This planning area consists of all of M3, just over 37% of M1, and approximately 44% of M4. This area is zoned as RS-12000 and existing development is consistent with this zoning. Development in a large fraction of this area is impacted to some degree by steep slopes.

Indicator	Estimate
Impervious surface area (%)	< 20%
Vegetation coverage; percent by class	Varied
Shoreline stabilization; Linear feet of bulkheads, retaining walls, etc.	>85% significant armor
Piers/docks/floats, overwater structures; number or sq. ft.	Limited but present
Wetlands acreage	None or Low
Water quality; DOE 303 (d) list	Unlisted
Bald eagle & osprey nests and roosts & great blue heron rookeries	Multiple nests and roosts
Area of sea grasses, kelp, and emergent aquatic vegetation	Present
Road lengths (ft) within 200' of water body	< 500'
Acres of permanently protected areas	Limited

Table 5: Overview of NNL indicators for SR-AL

Additional insights emerge if the private properties in this area are partitioned into four sets; homes on generally **level** terrain, homes generally towards the **low** side of a steep slope, homes generally towards the **high** side of a steep slope, and **undeveloped** properties. Table 6 indicates the proportions of each category, the typical setbacks, and the components for the NNL metric where **B** is the bulkhead indicator, **P** is the score for partially functioning areas, and **N** is for native vegetation.

	Length		Setbacks	Metric					
				B	First 100'		Second 100'		Total
	ft	%			P	N	P	N	
Level	3,339	24.8	41 - 90	0.3	0.5 * 2	0.0 * 6	0.2 * 1	0.1 * 3	2.0
Low	6,698	49.6	20 - 50	0.0	0.1 * 2	0.4 * 6	0.1 * 1	0.6 * 3	4.7
High	2,197	15.7	126 - 233	0.0	0.1 * 2	0.8 * 6	0.1 * 1	0.4 * 3	6.0
Undev (Pri)	803	5.9	NA	0.0	0.1 * 2	0.9 * 6	0.1 * 1	0.9 * 3	8.2
Undev (Other)	525	3.9	NA	0.8	0.1 * 2	0.8 * 6	0.0 * 1	0.8 * 3	8.1
Total	13,562	100.0	30 - 94	0.1	0.4	2.5	0.1	1.4	4.6

Table 6: Indicators for four categories of development in the Altered portion of the Marine

5.4) SR-HA

This planning area consists of approximately 63% of M1 plus 56% of M4. This area is zoned as RS-12000 but existing development is more consistent with RS-7200. Development in a large fraction of this area is impacted to a significant degree by steep slopes and roadways.

Indicator	Estimate
Impervious surface area (%)	Dominates area
Vegetation coverage; percent by class	Minor landscaping
Shoreline stabilization; Linear feet of bulkheads, retaining walls, etc.	~100% modest bulkhead
Piers/docks/floats, overwater structures; number or sq. ft.	None
Wetlands acreage	None or Low
Water quality; DOE 303 (d) list	Unlisted
Bald eagle & osprey nests and roosts & great blue heron rookeries	None
Area of sea grasses, kelp, and emergent aquatic vegetation	Present
Road lengths (ft) within 200' of water body	5600
Acres of permanently protected areas	None

Table 7: Overview of NNL indicators for SR-HA

The three segments in M1 are constrained to the rear by roadways that runs at the base of steep slopes. The water ward side of the road is highly altered and the landward side is heavily vegetated. Two of the segments in M4 are on level ground and are constrained to the rear by roads. Homes along SW 172nd St are constrained by a roadway in the front and a steep slope to the rear.

Table 8 is similar in structure to Table 6 and treats SW 172nd St separately. [Note: This table may show the result of rounding].

	Length		Setback	Metric				
				B	First 100'		Second 100'	
	ft	%			P	N	P	N
Rest	4,644	72.0	25 - 35	0.2	0.2 * 2	0.0 * 6	0.0 * 1	0.7 * 3
SW 172nd St	1,810	28.0	70 - 95	0.5	0.0 * 2	0.0 * 6	0.0 * 1	0.7 * 3
Total	6,454	100.0	25 - 75	0.3	0.2	0.1	0.0	2.2

Table 8: Indicators for the Highly Altered portion of the Marine

6) Summary for the Planning Areas

Table 9 provides a summary of the setbacks and the NNL metric for the four planning areas ordered by the No Net Loss (NNL) metric.

Area UC-NA scores highest for this metric. Two of the segments, totaling about 25% of this area, are almost completely unaltered. Seahurst Park, the primary opportunity for public access along Burien's shoreline, is somewhat altered within the first 100' of OHWM.

Area SR-AL demonstrates a relatively high level of ecological function but this is primarily due to the significant levels of native vegetation on the steep slopes that dominate this planning area. The position of the slope relative to OHWM tends to alter the location of the native vegetation within the first 200'. It is intriguing to note that typical setbacks are larger for **level** parcels than for the **low** parcels; it appears that many property owners prefer to include lawns between the primary structure and OHWM if there is sufficient space to do so.

Area SR-HA achieves a relatively high measure on this planning metric. This can be seen to be a consequence of the abundant native vegetation that exists on the steep slopes behind 30th Ave SW and Standing Lane SW, and hence further than 100' from OHWM, and the relatively less substantial bulkheads.

Finally SR-LB achieves the lowest score on this metric despite having the largest typical setbacks and relatively low levels of building coverage and impervious surface. This is a consequence of the priority that is accorded to native vegetation when it does exist and the fact the Lake Burien is largely landscaped. It appears that conditions in the planning area are broadly comparable to the level properties that exist along Puget Sound.

	Style	Length		Setback	Area (sq. ft.) (000's)	Metric			
		(ft)	(%)			B	1st 100'	2nd 100'	Total
SR-LB	Level	5,374	100.0	80 - 125	15.1 - 26.1	0.3	1.8	0.4	2.6
UC-NA	Natural	5,811	22.5	> 200	46.3 - 69.6	0.7	4.9	3.0	8.6
SR-AL	Level	3,339	12.9	41 - 90	11.3 - 19.0	0.3	1.2	0.5	2.0
	Low	6,698	25.9	20 - 50	6.8 - 15.6	0.0	2.7	1.9	4.7
	High	2,197	8.5	126 - 233	13.9 - 21.2	0.0	4.8	1.2	6.0
	Undev	1,328	5.1	NA	11.4 - 32.1	0.4	5.3	2.6	8.3
	Total	13,562	52.5	30 - 94	8.2 - 17.5	0.1	3.0	1.5	4.6
SR-HA	Exc 172	4,644	18.0	25 - 35	5.0 - 8.5	0.2	0.5	2.2	2.9
	172nd	1,810	7.0	70 - 95	7.2 - 10.4	0.5	0.1	2.1	2.6
	Total	6,454	25.0	25 - 75	5.2 - 9.4	0.3	0.4	2.2	2.8
Marine	Total	25,827	100.0	30 - 90	7.4 - 15.0	0.3	2.7	2.0	5.0

Table 9: Indicators for Burien's Lake and Marine Shorelines

The no-net-loss planning metric provides an indicator of where ecological function is most concentrated within the shorelines. This metric is logically based on a strip of land 1' wide and 200' deep which can then be summed over any length of shoreline and averaged. One can use the same strategy to compute the total value of the metric for the entire shoreline and then compute the portion of this total for each of the partitions identified in Table 9.

The result of this is shown in Table 10. This view of the information confirms the expectation that UC-NA represents a greater fraction of the total ecological function than its relative length would suggest while SR-HA represents a smaller fraction than its relative length. This view of the planning metric also emphasizes that the ecological function that is present in SR-HA is heavily skewed to the second 100' from OHWM.

Circumstances are reversed around Lake Burien. There is relatively little native vegetation around the lake, similar to level properties on the marine, and conditions are dominated by landscaping and impervious surface with the impervious surface typically in the 2nd 100' from OHWM.

	Style	Length		Metric as % of Total Score			
		(ft)	(%)	B	1st 100'	2nd 100'	Total
SR-LB	Level	5,374	100.0	10.0	74.1	18.5	100.0
UC-NA	Natural	5,811	22.5	2.6	17.0	13.1	32.7
SR-AL	Level	3,339	12.9	0.5	4.0	2.0	6.5
	Low	6,698	25.9	0.0	11.1	12.6	23.6
	High	2,197	8.5	0.0	9.2	4.9	14.2
	Undev	1,328	5.1	0.0	6.0	3.0	9.0
	Total	13,562	52.5	0.5	30.3	22.5	53.3
SR-HA	Exc 172	4,644	18.0	1.7	0.7	7.7	10.1
	172nd	1,810	7.0	0.7	0.0	3.3	3.9
	Total	6,454	25.0	2.4	0.7	10.9	14.0
Marine	Total	25,827	100.0	5.5	52.1	38.9	100.0

Table 10: Indicators for Burien's Marine and Lake Shorelines

7) Primary challenges to No Net Loss from Future Development

Meeting the no net loss standard in Burien's altered urban shoreline requires attention to a limited number of issues. Burien does not have any commercial or industrial development within the shoreline jurisdiction and there are no plans for such development within a 25 year planning horizon.

The shoreline is primarily public parks and private properties that are developed as single family residences. The Ruth Dykeman Children's Center on Lake Burien is a non-profit group home that is developed at a level that is comparable to the private homes around Lake Burien and it is subject to special planning rules in Burien's comprehensive plan.

Meeting the No Net Loss requirement is therefore primarily a matter of considering the patterns of development that are typical of redevelopment of private properties consistent with current zoning regulations.

7.1) Development Creep

Consideration of the No Net Loss standard in an altered urban environment comparable to Burien's suggests a focus on the question of *development creep*; a presumption by some parties that over time there is a natural desire for property owners to move towards OHWM. While some may debate the particulars of this pressure it is hard to claim that this concern is invalid. The question then is where this potential pressure will have the most influence in Burien.

7.1.1) Undeveloped private properties

There are 11 undeveloped private properties; one is a small unbuildable property on Lake Burien and the other 10 are in the Marine shoreline and specifically in SR-AL.

The private properties along the marine have a total footage of just over 800' i.e. approximately 3.1% of the marine shoreline by length. All of the properties include significant bulkheads. It is difficult to guess how any of these properties might be developed over a 20 year planning horizon. Seven of these properties are in an unaltered state with the exception of the bulkheads but the remaining three are being maintained in a less natural condition.

Three properties have not had any sales transactions in the last 30 years, three have not had transactions in over 20 years, and the remaining four have had more recent transfers. One of the undeveloped properties in M3-A was purchased in 2012.

7.1.2) Relocation of existing structures

Several elements of the SMP guidelines concern the possibility of existing homes being relocated; either the risk of adverse impacts if a home is relocated substantially closer to OHWM or the restorative benefit that might occur if a home is relocated substantially further from OHWM whether voluntarily or after unplanned destruction.

SR-LB: The properties around Lake Burien are on generally level ground with typical setbacks of 80 - 125'. The sewer pipe for this neighborhood is approximately 45' from OHWM which limits adverse alterations beyond that point.

UC-NA: It appears relatively unlikely that any of the structures in this area will be relocated. There is one private residence towards OHWM that was developed by subdividing an existing parcel on the extremely steep slope. This property could not be relocated at the top of the slope.

SR-AL: Almost 10% of this area is undeveloped; this includes the community beach. Approximately 65% of this area is impacted by steep slopes with homes at either the top or bottom of the slope. Nearly 1/2 of these homes are further constrained by the Indian Trail. It is believed that relocation of the homes across the slope will be relatively unusual. The final 25% of this area is generally level. Homes are typically towards the rear of these properties, with setbacks of 41' to 90' and these are candidates for relocation towards OHWM.

SR-HA: The proximity of roads and/or steep slopes means that none of these homes are plausible candidates for relocation.

7.1.3) Expansion of existing structures

This is likely to be the most common pressure for new development that presents a risk of adverse impacts.

SR-LB: This area is zoned as RS-7200 but existing development is generally consistent with RS-12000. The homes are typically setback 80' - 125' from OHWM on generally level ground. It is reasonable to expect that some of these homes will be candidates for expansion in a 20 year planning horizon.

UC-NA: Twelve of the thirteen private properties in this area are well outside shoreline jurisdiction. The remaining home is located on a challenging slope and hence is unlikely to be expanded.

SR-AL: This area is 52.5% of the marine shoreline and 50% of the properties are developed towards OHWM at the base of a steep slope. Many of these residences occupy a substantial fraction of the buildable space. However there are a number of more modest structures, some of which have not been renovated in many years that are candidates for meaningful redevelopment.

SR-HA: These properties are developed with levels of building coverage and impervious surface that approach or exceed the standards for RS-12000. If any of these homes are expanded it is likely to be on to existing impervious surface.

7.1.4) New accessory structures and appurtenances

It is reasonable to anticipate some desire for new accessory structures such as garages, beach cabanas, and tool sheds within shoreline jurisdiction.

SR-LB: Many of the homes around Lake Burien include garages and it is expected that new garages would be placed on the landward side of the existing primary residence. It has already been noted that the typical home is setback by more than 80' from OHWM and that the terrain is generally level and landscaped. It is reasonable to anticipate that some residents will have an interest in erecting small structures on the water ward side of the existing sewer pipe, i.e. within 45' of OHWM, if the updated SMP allows this.

UC-NA: The location of the existing homes and the steep terrain make it highly unlikely that private property owners will attempt to construct new accessory structures within 200' of OHWM..

SR-AL: It has been noted that approximately 25% of this planning area is on relatively level ground with typical setbacks of over 40'. A number of these homes include cabanas and it can be imagined that other property owners may have an interest in adding a structure of this type.

Approximately 50% of this planning area is developed with homes at the base of a steep slope. Typical setbacks are between 20' and 50' and the home tends to back in to the slope. This leaves relatively little room to add an accessory structure towards OHWM.

Approximately 20% of this planning area is developed with homes at the top of a steep slope. Many of these properties include an accessory structure at the base of the slope that is accessed by tram or steep walkway. It is feasible that other property owners would seek to add modest cabanas if allowed.

SR-HA: These properties are highly developed towards OHWM and it is relatively unlikely that residents will attempt to add accessory structures between the primary residence and OHWM. Most of the properties in this planning area either have garages or have relatively little room to construct a garage without major renovation to the home.

7.2) Shoreline stabilization

The SMP guidelines include several sections that are intended to limit the creation or expansion of new structures for flood hazard reduction or shoreline stabilization.

SR-LB: The level of Lake Burien varies by approximately 3' during the year. Approximately 3/4 of the properties include a bulkhead or retaining wall to stabilize the shore. The longevity of development around the lake suggests that the level of stabilization has achieved a steady state.

UC-NA: Most of the bulkheads in this area are located in Seahurst Park. These bulkheads are being removed or reconfigured over time to reduce the possible impacts of these structures.

SR-AL: With the exception of M1-A, the last few hundred feet of M3-C and all of M3-D, the properties in this planning area include substantial bulkheads. These are frequently well over 4' tall, some are over 8' tall, and experience heavy wave action on a regular basis. There is little likelihood that these structures can be removed.

SR-HA: Nearly every property in this planning area includes a bulkhead. These are relatively modest in size for M1-B, M4-A, and M4-B, somewhat more significant in M1-D, and stand well over 6' in M4-C. With typical setbacks of 25' - 35', excluding SW 172nd St, there is little likelihood that these structures can be removed

There is a concern that climate change will raise sea level over time and/or increase the severity of storms. This may introduce pressure to expand and reinforce existing bulkheads along the Marine. There is debate about the specifics of this effect but it is anticipated that, if necessary, this issue will be accommodated by changes to state regulation and hence should not receive particular attention in this update.

8) Summary

This analysis synthesizes the information provided in the *Supplement to the Shoreline Inventory* in a manner that facilitates an understanding of the broad patterns of development to be found in Burien's shorelines. The nineteen inventory segments are grouped in to four planning areas based on environment and development conditions.

Lake Burien is a fresh water lake and development conditions are relatively uniform. The lake is zoned as RS-7200 but current conditions are broadly consistent with RS-12000. These properties are extensively landscaped. The majority of the properties include shoreline stabilization but these are relatively modest structures that protect the property during the annual cycle of change in the level of the lake.

Approximately 22.5% of the marine shoreline, by length, is in a relatively natural condition with abundant native vegetation. The primary alterations in this area are to support public access at Seahurst Park. This park has received significant attention to restore conditions with a focus on reconfiguring the bulkheads.

Approximately 52.5% of the marine shoreline is altered. This area is zoned as RS-12000 and conditions are generally consistent with this designation. Much of this area is impacted by steep slopes and these slopes are where native vegetation is particularly common. The majority of these properties include substantial bulkheads.

The final 25% of the marine shoreline is highly altered particularly in the first 100' from OHWM. Most of these properties include bulkheads but they are generally less substantial than in the remainder of the marine Shoreline Residential environmental designation.

The variety of conditions within these planning areas suggests that it is appropriate to define four dimension standards for regulating new development within Shoreline Jurisdiction.